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Coke Manufacturing

Industry Description and Practices

Coke and coke by-products, including coke oven gas, are produced by the pyrolysis (heating in the absence of air) of suitable grades of coal. The process also includes the processing of coke oven gas to remove tar, ammonia (usually recovered as ammonium sulfate), phenol, naphthalene, light oil, and sulfur before the gas is used as fuel for heating the ovens. This document covers the production of metallurgical coke and the associated by-products using intermittent horizontal retorts.

In the coke-making process, bituminous coal is fed (usually after processing operations to control the size and quality of the feed) into a series of ovens, which are sealed and heated at high temperatures in the absence of oxygen, typically in cycles lasting 14 to 36 hours. Volatile compounds that are driven off the coal are collected and processed to recover combustible gases and other by-products. The solid carbon remaining in the oven is coke. It is taken to the quench tower, where it is cooled with a water spray or by circulating an inert gas (nitrogen), a process known as dry quenching. The coke is screened and sent to a blast furnace or to storage.

Coke oven gas is cooled, and by-products are recovered. Flushing liquor, formed from the cooling of coke oven gas, and liquor from primary coolers contain tar and are sent to a tar decanter. An electrostatic precipitator is used to remove more tar from coke oven gas. The tar is then sent to storage. Ammonia liquor is also separated from the tar decanter and sent to wastewater treatment after ammonia recovery. Coke oven gas is further cooled in a final cooler. Naphthalene is removed in the separator on the final cooler. Light oil is then removed from the coke oven gas and is fractionated to recover benzene, toluene, and xylene. Some facilities may include an onsite tar distillation unit. The Claus process is normally used to recover sulfur from coke oven gas.

During the coke quenching, handling, and screening operation, coke breeze is produced. It is either reused on site (e.g., in the sinter plant) or sold off site as a by-product.

Waste Characteristics

The coke oven is a major source of fugitive air emissions. The coking process emits particulate matter (PM); volatile organic compounds (VOCs); polynuclear aromatic hydrocarbons (PAHs); methane, at approximately 100 grams per metric ton (g/t) of coke; ammonia; carbon monoxide; hydrogen sulfide (50–80 g/t of coke from pushing operations); hydrogen cyanide; and sulfur oxides, SO_x (releasing 30% of sulfur in the feed). Significant amount of VOCs may also be released in by-product recovery operations.

For every ton of coke produced, approximately 0.7 to 7.4 kilograms (kg) of PM, 2.9 kg of SO_x (ranging from 0.2 to 6.5 kg), 1.4 kg of nitrogen oxides (NO_x), 0.1 kg of ammonia, and 3 kg of VOCs (including 2 kg of benzene) may be released into the atmosphere if there is no vapor recovery system. Coal-handling operations may account for about 10% of the particulate load. Coal charging, coke pushing, and quenching are major sources of dust emissions.

Wastewater is generated at an average rate ranging from 0.3 to 4 cubic meters (m^3) per ton of coke processed. Major wastewater streams are generated from the cooling of the coke oven gas and the processing of ammonia, tar, naphthalene, phenol, and light oil. Process wastewater may contain 10 milligrams per liter (mg/l) of benzene, 1,000 mg/l of biochemical oxygen demand (BOD) (4 kg/t of coke), 1,500–6,000 mg/l of chemical oxygen demand (COD), 200 mg/l of total sus-

pended solids, and 150–2,000 mg/l of phenols (0.3–12 kg/t of coke). Wastewaters also contain PAHs at significant concentrations (up to 30 mg/l), ammonia (0.1–2 kg nitrogen/t of coke), and cyanides (0.1–0.6 kg/t of coke).

Coke production facilities generate process solid wastes other than coke breeze (which averages 1 kg/t of product). Most of the solid wastes contain hazardous components such as benzene and PAHs. Waste streams of concern include residues from coal tar recovery (typically 0.1 kg/t of coke), the tar decanter (0.2 kg/t of coke), tar storage (0.4 kg/t of coke), light oil processing (0.2 kg/t of coke), wastewater treatment (0.1 kg/t of coke), naphthalene collection and recovery (0.02 kg/t of coke), tar distillation (0.01 kg/t of coke), and sludges from biological treatment of wastewaters.

Pollution Prevention and Control

Pollution prevention in coke making is focused on reducing coke oven emissions and developing cokeless iron- and steel-making techniques. The following pollution prevention and control measures should be considered.

General

- Use cokeless iron- and steel-making processes, such as the direct reduction process, to eliminate the need to manufacture coke.
- Use beneficiation (preferably at the coal mine) and blending processes that improve the quality of coal feed to produce coke of desired quality and reduce emissions of sulfur oxides and other pollutants.
- Use enclosed conveyors and sieves for coal and coke handling. Use sprinklers and plastic emulsions to suppress dust formation. Provide windbreaks where feasible. Store materials in bunkers or warehouses. Reduce drop distances.
- Use and preheat high-grade coal to reduce coking time, increase throughput, reduce fuel consumption, and minimize thermal shock to refractory bricks.

Coke Oven Emissions

- *Charging:* dust particles from coal charging should be evacuated by the use of jumper-pipe systems and steam injection into the ascension pipe or controlled by fabric filters.
- *Coking:* use large ovens to increase batch size and reduce the number of chargings and pushings, thereby reducing the associated emissions. Reduce fluctuations in coking conditions, including temperature. Clean and seal coke oven openings to minimize emissions. Use mechanical cleaning devices (preferably automatic) for cleaning doors, door frames, and hole lids. Seal lids, using a slurry. Use low-leakage door construction, preferably with gas sealings.
- *Pushing:* emissions from coke pushing can be reduced by maintaining a sufficient coking time, thus avoiding "green push." Use sheds and enclosed cars, or consider use of traveling hoods. The gases released should be removed and passed through fabric filters.
- *Quenching:* where feasible, use dry instead of wet quenching. Filter all gases extracted from the dry quenching unit. If wet quenching, is used, provide interceptors (baffles) to remove coarse dust. When wastewater is used for quenching, the process transfers pollutants from the wastewater to the air, requiring subsequent removal. Reuse quench water.
- *Conveying and sieving:* enclose potential dust sources, and filter evacuated gases.

By-Product Recovery

- Use vapor recovery systems to prevent air emissions from light oil processing, tar processing, naphthalene processing, and phenol and ammonia recovery processes.
- Segregate process water from cooling water.
- Reduce fixed ammonia content in ammonia liquor by using caustic soda and steam stripping.
- Recycle all process solid wastes, including tar decanter sludge, to the coke oven.
- Recover sulfur from coke oven gas. Recycle Claus tail gas into the coke oven gas system.

Target Pollution loads

Implementation of cleaner production processes and pollution prevention measures can yield both economic and environmental benefits. The pro-

Table 1. Air Emissions, Coke Manufacturing
(kilograms per ton of coke produced)

Parameter	*Maximum value*
VOCs	0.3
Benzene	0.1
Particulate matter	0.15
Sulfur oxides	0.5
Nitrogen oxides	0.6
TSS	50
Oil and grease	10
Phenol	0.5
Benzene	0.05
Dibenz(a,h)anthracene	0.05
Benzo(a)pyrene	0.05
Cyanide (total)	0.2
Nitrogen (total)	10
Temperature increase	≤ 3° C[a]

Note: Effluent requirements are for direct discharge to surface waters.
a. The effluent should result in a temperature increase of no more than 3° C at the edge of the zone where initial mixing and dilution take place. Where the zone is not defined, use 100 meters from the point of discharge.

duction-related targets described below can be achieved by adopting good industrial practices.

Air Emissions

Emissions should be reduced to the target levels presented in Table 1.

Wastewater

The generation rate for wastewater should be less than 0.3 m^3/t of coke.

Solid and Hazardous Wastes

New coke plants should not generate more than 1 kg of process solid waste (excluding coke breeze and biosludges) per ton of coke.

Treatment Technologies

Air Emissions

Air emission control technologies include scrubbers (removal efficiency of 90%) and baghouses and electrostatic precipitators (ESPs), with removal efficiencies of 99.9%. Baghouses are preferred over venturi scrubbers for controlling particulate matter emissions from loading and pushing operations because of the higher removal efficiencies. ESPs are effective for final tar removal from coke oven gas.

Wastewater Treatment

Wastewater treatment systems include screens and settling tanks to remove total suspended solids, oil, and tar; steam stripping to remove ammonia, hydrogen sulfide, and hydrogen cyanide; biological treatment; and final polishing with filters.

The levels presented in Table 2 should be achieved.

Solid Waste Treatment

All process hazardous wastes except for coke fines should be recycled to coke ovens. Wastewater treatment sludges should be dewatered. If toxic organics are detectable, dewatered sludges are to be charged to coke ovens or disposed in a secure landfill or an appropriate combustion unit.

Emissions Guidelines

Emissions levels for the design and operation of each project must be established through the environmental assessment (EA) process on the basis of country legislation and the *Pollution Prevention and Abatement Handbook*, as applied to local conditions. The emissions levels selected must be

Table 2. Target Wastewater Loads per Unit of Production, Coke Manufacturing
(grams per ton of coke produced, unless otherwise specified)

Parameter	*Maximum value*
COD	100
Benzene	0.015
Benzo(a)pyrene	0.009
Naphthalene	0.0008
Nitrogen (total)	12
Cyanide (free)	0.03
Phenol	0.15
Wastewater	0.3 m^3/t of coke produced

justified in the EA and acceptable to the World Bank Group.

The guidelines given below present emissions levels normally acceptable to the World Bank Group in making decisions regarding provision of World Bank Group assistance. Any deviations from these levels must be described in the World Bank Group project documentation. The emissions levels given here can be consistently achieved by well-designed, well-operated, and well-maintained pollution control systems.

The guidelines are expressed as concentrations to facilitate monitoring. Dilution of air emissions or effluents to achieve these guidelines is unacceptable.

All of the maximum levels should be achieved for at least 95% of the time that the plant or unit is operating, to be calculated as a proportion of annual operating hours.

Air Emissions

Benzene emissions should not be more than 5 milligrams per normal cubic meter (mg/Nm^3) in leaks from light oil processing, final cooler, tar decanter, tar storage, weak ammonia liquor storage, and the tar/water separator. VOC emissions should be less than 20 mg/Nm^3. Particulate matter emissions from the stacks should not exceed 50 mg/Nm^3. Sulfur recovery from coke oven gas should be at least 97% but preferably over 99%.

Liquid Effluents

The effluent levels presented in Table 3 should be achieved.

Solid and Hazardous Wastes

Solid hazardous wastes containing toxic organics should be recycled to a coke oven or treated in a combustion unit, with residues disposed of in a secure landfill.

Table 3. Effluents, Coke Manufacturing
(milligrams per liter, unless otherwise specified)

Parameter	*Maximum value*
BOD	30
COD	150

Ambient Noise

Noise abatement measures should achieve either the levels given below or a maximum increase in background levels of 3 decibels (measured on the A scale) [dB(A)]. Measurements are to be taken at noise receptors located outside the project property boundary.

	Maximum allowable log equivalent (hourly measurements), in dB(A)	
Receptor	*Day (07:00–22:00)*	*Night (22:00–07:00)*
Residential, institutional, educational	55	45
Industrial, commercial	70	70

Monitoring and Reporting

Stack air emissions should be monitored continuously for particulate matter. Alternatively, opacity measurements of stack gases could suffice. Fugitive emissions should be monitored annually for VOCs. Wastewater discharges should be monitored daily for flow rate and for all parameters, except for dibenz(a,h)anthracene and benzo(a)pyrene. The latter should be monitored at least on a monthly basis or when there are process changes. Frequent sampling may be required during start-up and upset conditions.

Monitoring data should be analyzed and reviewed at regular intervals and compared with the operating standards so that any necessary corrective actions can be taken. Records of monitoring results should be kept in an acceptable format. The results should be reported to the responsible authorities and relevant parties, as required.

Key Issues

The key production and control practices that will lead to compliance with emissions guidelines can be summarized as follows:

- Use cokeless iron- and steel-making processes, such as the direct reduction process for iron-making, to eliminate the need for coke manufacturing.
- Where feasible, use dry quenching instead of wet quenching.
- Use vapor-recovery systems in light oil processing, tar processing and storage, naphthalene processing, and phenol and ammonia recovery operations.
- Recover sulfur from coke oven gas.
- Segregate process and cooling water.
- Recycle process solid wastes to the coke oven.

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Summary of Air Emission and Effluent Discharge Requirements Presented in the Industry Guidelines

Terms Used in the following Tables 1–3

ADP	Air-dried pulp
Ag	Silver
AOX	Adsorbable organic halides
As	Arsenic
BOD	Biochemical oxygen demand (understood as BOD measured over five days, BOD_5)
Cd	Cadmium
Cl	Chlorine
CN	Cyanide
Co	Cobalt
CO	Carbon monoxide
COD	Chemical oxygen demand
Cr^{+6}	Hexavalent chromium
Cr, total	Total chromium
CTMP	Chemical, thermal, mechanical process for producing pulp
Cu	Copper
F	Fluorine
Fe	Iron
g/mm Btu	Grams per million British thermal units
GJ	Gigajoule
HC	Hydrocarbons
HCl	Hydrogen chloride/hydrochloric acid
HF	Hydrogen fluoride/hydrofluoric acid
Hg	Mercury
H_2S	Hydrogen sulfide
kg	Kilogram
kg/t	Kilograms per metric ton
mg/l	Milligrams per liter
$\mu g/m^3$	Micrograms per cubic meter
mg/Nm^3	Milligrams per normal cubic meter
MPN/100 ml	Coliform count expressed as most probable number per 100 milliliters
MWe	Megawatts of electricity
N	Nitrogen
ng/J	Nanograms per joule
NH_3	Ammonia
NH_4	Ammonium nitrogen
Ni	Nickel
NO_3	Nitrate nitrogen
NO_x	Nitrogen oxides
O&G	Oil and grease
P	Phosphorus
PAH	Polynuclear aromatic hydrocarbons
Pb	Lead
pH	Measure of acidity/alkalinity
PM	Particulate matter
$PM_{2.5}$	Particulate matter with aerodynamic diameter less than 2.5 microns
PM_{10}	Particulate matter with aerodynamic diameter less than 10 microns
ppm	Parts per million
S	Sulfur
Sb	Antimony
Se	Selenium
Sn	Tin
SO_2	Sulfur dioxide
SO_x	Sulfur oxides
t	Metric ton
TCE	Trichloroethylene
Temp. increase	Temperature increase at the edge of the zone where initial mixing and dilution take place; where the zone is not defined, 100 meters from the point of discharge is used
tpd/MWe	Metric tons per day per megawatt of electricity
TSS	Total suspended solids
V	Vanadium
VOCs	Volatile organic compounds
WAD	Weak acid dissociable cyanide
Zn	Zinc

Table 1. Air Emission Requirements: Parameters and Maximum Values

(mg/Nm³, unless otherwise specified)

Guideline	*PM*	*SO_x*	*NO_x*	*Other; comments*
Aluminum manufacturing	30			Total F: 2; HF: 1; VOCs: 20
Base metal and iron ore mining				
Breweries				
Cement manufacturing	50	400	600	
Chlor-alkali industry				Cl: 3
Coal mining and production	50			
Coke manufacturing	50			Benzene: 5 (leaks); VOCs: 20; sulfur recovery at least 97% (preferably over 99%)
Copper smelting	*	1,000 (SO_2)		PM: smelters, 20, other sources, 50; As: 0.5; Cd: 0.05; Cu: 1; Pb: 0.2; Hg: 0.05
Dairy industry	50			Odor: acceptable to neighbors
Dye manufacturing				Cl: 10: VOCs: 20
Electronics manufacturing				VOCs: 20; phosphine: 1; arsine: 1; HF: 5; HCl: 10
Electroplating industry				VOCs: 90% recovery
Foundries	*			PM: 20 where toxic metals are present, 50 in other cases
Fruit and vegetable processing				
General environmental guidelines	*	2,000 (SO_2)	Coal: 750 (260 ng/J or 365 ppm) Oil: 460 (130 ng/J or 225 ppm) Gas: 320 (86 ng/J or 155 ppm)	PM: 50 for ≥ 50 MWe; 100 < 50MWe; dioxins: 2,3,7,8-TCSS equivalent): maximum of 1 ng/Nm³
Glass manufacturing	*	Oil fired: 1,800 Gas fired: 700	1,000 (up to 2,000 depending on technology and if justified in the EA)	PM: 50 (20 where toxic metals are present); Pb + Cd: 5; heavy metals (other, total): 5; As: 1; F: 5; HCl: 50
Industrial estates	*	2,000	Solid fuels: 750 (260 ng/J or 365 ppm); Liquid fuels: 460 (130 ng/J or 225 ppm); Gaseous fuels: 320 (86 ng/J or 155 ppm)	PM: 50 (> 10 GJ/hr), 150 (< 10 GJ/hr); H_2S: 15
Iron and steel manufacturing	50	500 (sintering)	750 (260 ng/J or 365 ppm)	F: 5
Lead and zinc smelting	20	400 (SO_2)		As: 0.1; Cd: 0.05; Cu: 0.5; Hg: 0.05; Pb: 0.5; Zn: 1
Meat processing and rendering	*			PM: 150 for smokehouses with a carbon content of less than 50; odor: minimize impacts on residents
Mini steel mills	*	2,000	750	PM: 20 where toxic metals are present, 50 in other cases
Mixed fertilizer plants	50		500 (nitrophosphate unit) 70 (mixed acid unit)	NH_3: 50; F: 5

Nitrogenous fertilizer plants	50		300	NH_3: 50; urea: 50
Oil and gas development (onshore)		1,000	Oil: 460 (130 ng/J or 225 ppm) Gas: 320 (86 ng/J or 155 ppm)	VOCs: 20; H_2S: 30; odor: not offensive at receptor end (H_2S at the property boundary should be less than 5 $\mu g/m^3$)
Pesticides formulation	*			PM: 20 (5 where very toxic compounds are present); VOCs: 20; Cl: 5
Pesticides manufacturing	*			PM: 20 (5 where very toxic compounds are present); VOCs: 20; Cl: 5
Petrochemicals manufacturing	20	500	300	HCl: 10; benzene: 5 (emissions), 0.1 ppb (plant fence); 1,2-dichloroethane: 5 (emissions), 1.0 ppb (plant fence); vinyl chloride: 5 (emissions), 0.4 ppb (plant fence); NH_3: 15
Petroleum refining	50	150 (sulfur recovery units) 500 (combustion units)	460 (130 ng/J or 225 ppm)	H_2S: 15; Ni + V: 2
Pharmaceutical manufacturing	20			Active ingredients (each): 0.15; Class A com pounds (total): 20; Class B compounds (total): 80; benzene, vinyl chloride, dichloroethane (each): 5
Phosphate fertilizer plants	50	Sulfuric acid plant: SO_2: 2 kg/t acid SO_3: 0.15 kg/t acid		F: 5
Printing industry				VOCs: 20; Cl: 10
Pulp and paper mills	*		2 kg/t ADP	PM: 100 (recovery furnace); H_2S: 15 (lime kilns); S (total): 1.5 kg/ton ADP (sulfite mills), 1.0 kg/ton ADP (kraft and other)
Sugar manufacturing	*	2,000	Liquid fuels: 460 (130 ng/J or 225 ppm) Solid fuels: 750 (260 ng/J or 365 ppm)	PM: 100 (150 mg/ Nm^3 for small mills with less than 8.7 MW heat input to the boiler); odor: acceptable to residents
Tanning and leather finishing				Odor: acceptable to neighbors
Textiles industry				VOC: 20
Thermal power, new plants	50*	0.2 tpd/MWe (to 500 MWe) 0.1 tpd/MWe (incr. over 500 MWe) Not to exceed 2,000 mg/Nm^3 in flue gases Not to exceed 500 tpd	For thermal power plants: Coal: 750 (260 ng/J or 365 ppm); Oil: 460 (130 ng/J or 225 ppm); Gas: 320 (86 ng/J or 155 ppm) For combustion turbine units: Gas: 125 Diesel fuel (No. 2 oil): 165 Fuel oil (No. 6 and other): 300	Less than 50 MWe: PM 100; for coal with less than 10% volatile matter, NO_x is 1,500 mg/Nm^3
Thermal power, rehabilitation of existing plants	100*			In rare cases, 150 mg/Nm^3 PM is acceptable
Vegetable oil processing	50			Odor: acceptable to neighbors
Wood preserving industry				VOCs: 20

* See column headed "Other; comments."

Table 2. Effluent Discharge Requirements: Parameters and Maximum Values, Miscellaneous Parameters

(mg/l, except pH and as otherwise specified)

Guideline	*pH*	*BOD_5*	*COD*	*TSS*	*O&G*	*Phenol*	*CN^-*	*N*	*P*	*F*	*Cl*	*Coli-form*	*Temp. Increase*	*Other; comments*
Aluminum manufacturing	6–9		150	50						20			≤ 3˚C	HC: 5
Base metal and iron ore mining	6–9		150	50	10		Free: 0.1 WAD: 0.5 Total: 1.0							
Breweries	6–9	50	250	50	10			NH_4: 10	5				≤ 3˚C	
Cement manufacturing	6–9			50									≤ 3˚C	
Chlor-alkali industry	6–9		150	20							0.2			AOX: 0.5; sulfite: 1.0
Coal mining and production	6–9			50	10									TSS: 35 (monthly average)
Coke manufacturing		30	150	50	10	0.5	Total: 0.2	Total: 10					≤ 3˚C	Benzene: 0.05; dibenz(a,h)anthracene: 0.05; benzo(a)pyrene: 0.05
Copper smelting	6–9			50									≤ 3˚C	
Dairy industry	6–9	50	250	50	10			Total: 10	2			400 MPN/ 100 ml	≤ 3˚C	
Dye manufacturing	6–9	30	150	50	10	0.5								Total organic (each), e.g., benzidine: 0.05; AOX: 1 mg/l
Electronics manufacturing	6–9	50		*	10		Free: 0.1 Total: 1	NH_3: 10	5	20				TSS: 50 (maximum), 20 (monthly average); chlorocarbons and hydrochlorocarbons (total): 0.5
Electroplating industry	7–10			25	10		Free: 0.2		5	20				Trichloroethylene and trichloroethane (each): 0.05
Foundries	6–9			50	10								≤ 3˚C	
Fruit and vegetable processing	6–9	50	250	50	10			Total: 10	5					
General environmental guidelines	6–9	50	250	50	10	0.5	Total: 1 Free: 0.1	NH_3: 10	2	20	0.2	400 MPN/ 100 ml	≤ 3˚C	Sulfide: 1.0
Glass manufacturing	6–9		250	50	10									
Industrial estates	6–9	50	250	50*	10	0.5							≤ 3˚C	TSS: 20 mg/l where toxic metals are present at significant levels; sulfide: 1; AOX: 1; benzene: 0.05; benzo(a)pyrene: 0.05

Iron and steel manufacturing	6–9		250	50	10	0.5	Free: 0.1 Total: 1					≤ 3° C	
Lead and zinc smelting	6–9			20								≤ 3° C	
Meat processing and rendering	6–9	50	250	50	10			Total: 10	5		400 MPN/ 100 ml		
Mini steel mills	6–9			50	10							≤ 3° C	
Mixed fertilizer plants	6–9			50				NH_4: 10	5	20			
Nickel smelting and refining	6–9			50									
Nitrogenous fertilizer plants	6–9			50				NH_3: 10 Urea: 1				≤ 3° C	
Oil and gas development (onshore)	6–9	50		50	20*	1						≤ 3° C	O&G: up to 40 mg/l is acceptable for facilities producing < 10,000 tpd.; sulfide: 1
Pesticides formulation	6–9		150	20	10								TSS: 20, monthly average must not exceed 50 mg/l at any time; AOX: 1; organochlorines: 0.05; nitroorganics: 0.05; pyrethroids: 0.05; phenoxy compounds: 0.05; active ingredients (each): 0.05
Pesticides manufacturing	6–9	30	150	10	10	0.5							AOX: 1; active ingredients (each): 0.05; BOD test to be done only when no toxics to microorganisms are present
Petrochemicals manufacturing	6–9	30	150	30	10	0.5		Total: 10				≤ 3° C	Benzene: 0.05; vinyl chloride: 0.05; sulfide: 1
Petroleum refining	6–9	30	150	30	10	0.5		Total: 10				≤ 3° C	Benzene: 0.05; benzo(a)pyrene: 0.05; sulfide: 1
Pharmaceutical manufacturing	6–9	30*	150	10	10	0.5							AOX: 1; active ingredients (each): 0.05; BOD test to be done only when no toxics to microorganisms are present

(Table continues on the following page.)

Table 2. *(continued)*

Guideline	*pH*	*BOD_5*	*COD*	*TSS*	*O&G*	*Phenol*	*CN^-*	*N*	*P*	*F*	*Cl*	*Coli-form*	*Temp. Increase*	*Other; comments*
Phosphate fertilizer plants	6–9			50					5	20				
Printing industry	6.5–10	30	150	50	10									
Pulp and paper mills	6–9		*					0.4 kg/t	0.05 kg/t				≤ 3°C	COD: kraft and CTMP, 300 mg/l, 15 kg/t; sulfite, 700 mg/l, 40 kg/t; mechanical and recycled fiber, 10 mg/l, 5 kg/t; paper mills, 250 mg/l; AOX: 40 mg/l, 2 kg/t for new mills (target is 4 mg/l. 0.2 kg/t); 40 mg/l, 2 kg/t for retrofits (target is 8 mg/l, 0.4 kg/t); 4 mg/l for paper mills
Sugar manufacturing	6–9	50	250	50	10			NH_4: 10	2				≤ 3°C	
Tanning and leather finishing	6–9	50	250	50	10			NH_4: 10	2			400 MPN/ 100 ml		Sulfide: 1
Textiles industry	6–9	50	250	50	10	0.5						400 MPN/ 100 ml	≤ 3°C	AOX: 8; pesticides (each): 0.05; sulfide: 1
Thermal power	6–9			50	10						Total residual: 0.2*		≤ 3°C	Chlorine shocking: maximum value is 2 mg/l for up to 2 hours, not to be repeated more frequently than once in 24 hours, with a 24-hour average of 0.2 mg/l
Vegetable oil processing	6–9	50	250	50	10			Total: 10					≤ 3°C	
Wood preserving industry	6–9		150	50	10	0.5				20				PAHs (each): 0.05; pesticides (each): 0.05; dioxins/furans (sum of all): 0.0005

* See column headed "Other; comments."

Table 3. Effluent Discharge Requirements: Parameters and Maximum Values, Metals
(mg/l, unless otherwise specified)

Guideline	Ag	Al	As	Cd	Cr^{+6}	Cr	Cu	Fe	Hg	Ni	Pb	Sn	Zn	Total metals	Other; comments
						Total									
Aluminum manufacturing		0.2													
Base metal and iron ore mining			0.1	0.1	0.1		0.5	3.5	0.01	0.5	0.2		2	10	
Breweries															
Cement manufacturing															
Chlor-alkali industry															
Coal mining and production									3.5					10	
Coke manufacturing															
Copper smelting			0.1	0.1			0.5	3.5	0.01		0.1		1	10	
Dairy industry															
Dye manufacturing					0.1		0.5						2		
Electronics manufacturing			0.1	0.1	0.1		0.5		0.01	0.5	0.1	2		10	
Electroplating industry	0.5		0.1	0.1	0.1	0.5	0.5		0.01	0.5	0.2		2	10	
Foundries							0.5						2		
Fruit and vegetable processing															
General manufacturing	0.5		0.1	0.1	0.1	0.5		3.5	0.01	0.5	0.1		2	10	Se: 0.1
Glass manufacturing											0.1			10	
Industrial estates				0.1	0.1	0.5	0.5			0.5	0.1		2		
Iron and steel manufacturing				0.1		0.5			0.01		0.2		2		
Lead and zinc smelting			0.1	0.1			0.5	3.5	0.01		0.1		2	5	
Meat processing and rendering															
Mini steel mills				0.1	0.1	0.5	0.5			0.5	0.1				
Mixed fertilizer plants				0.1										10	
Nickel smelting and refining								3.5		0.5				10	
Nitrogenous fertilizer plants															
Oil and gas development (onshore)														See comments	Total toxic metals (antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, vanadium, zinc): 5
Pesticides formulation			0.1		0.1		0.5		0.01						
Pesticides manufacturing			0.1		0.1		0.5		0.01						
Petrochemicals manufacturing				0.1	0.1		0.5								

(Table continues on the following page.)

Table 3. *(continued)*

Guideline	Total Ag	Total Al	Total As	Total Cd	Total Cr^{+6}	Total Cr	Total Cu	Total Fe	Total Hg	Total Ni	Total Pb	Total Sn	Total Zn	Total metals	Other; comments
Petroleum refining					0.1	0.5					0.1				
Pharmaceutical manufacturing			0.1	0.1	0.1				0.01						
Phosphate fertilizer plants				0.1											
Printing industry	0.5			0.1	0.1	0.5	0.5	0.5						2	
Pulp and paper mills															
Sugar manufacturing															
Tanning and leather finishing					0.1	0.5									
Textiles industry						0.5	0.5			0.5			2		Co: 0.5
Thermal power						0.5	0.5	1					1		
Vegetable oil processing															
Wood preserving industry			0.1		0.1	0.5	0.5								

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WASTES GENERATED BY COKE AND COAL TAR PLANTS

JUL 24 1987

Mr. Richard Ekfelt
Director of Regulatory Affairs
American Coke and Coal Chemicals
Institute
1255 Twenty-third Street, NW
Washington, DC 20037

Dear Mr. Ekfelt:

Jeff Denit and I appreciated the opportunity to meet with you on June 3, 1987, to discuss the Agency's study to determine whether additional residual streams from by-product coke plants and coal tar refineries should be listed as hazardous wastes under RCRA. This meeting helped us understand the concerns of ACCCI members about the study; we hope that it clarified the objectives of EPA's study of the coke industry. This letter provides additional information to address the questions and concerns that were raised by ACCCI in your meeting with Ed Abrams and Dennis Wallace on May 14 and your May 26 letter to Mr. Abrams. The responses below are organized to be consistent with your letter.

1a. To date, "trigger" levels for specific constituents present in coke wastes have not been established. When established, these "trigger" levels will be health-based, not technology-based, and will be determined by first developing exposure limits for human consumption via drinking water and inhalation. Next, the exposure limits will be used to calculate leachate and air emission concentrations using models developed by the Agency that predict transport through ground water or dispersion through air. Finally, models that predict rates of constituent release from the waste will be used to calculate the regulatory levels in the residual streams.

1b. The term "primarily aqueous", as used in Mr. Wallace's letter to Mr. Eagle, referred to waste water streams. Specific examples include waste ammonia liquor, waste waters from direct contact final coolers and light oil

recovery operations, and tar refinery waste waters. The Agency has not established specific limits to define these streams; they essentially are the streams that are commonly defined by the industry as waste waters. The leachate procedure that will be used for the streams

is the same TCLP procedure that will be used for all streams. The TCLP procedure is defined in Appendix I to 40 CFR Part 268. (See 51 FR 40643 for a definition of the procedure.) For residuals that have less than 0.5 percent solids (a condition that we assume will hold for most waste waters), the residual stream is the leachate per that procedure.

2. Any waste water discharges that are point source discharges under Section 402 of the Clean Water Act are excluded from the definition of solid waste (and consequently are not hazardous wastes) per 40 CFR Part 261.4(a)(2). Further, persuant to 40 CFR Part 264.1 (g)(2), the requirements of Part 264 do not apply to the owner or operator of a wastewater treatment unit as defined in 40 CFR Part 261.10. Among other requirements, Part 261.10 defines waste water treatment unit as a device which is Part of a waste water treatment facility which is subject to regulation under either Section 402 or 307(b) of the Clean Water Act; and meets the definition of a tank (also defined in Section 261.10.). Thus, tanks may meet the criteria for the exclusion, but the exclusion would not apply to surface impoundments. As you are aware, some coke plant wastewaters are treated in surface impoundments rather than tanks; therefore, OSW is obligated to examine the need for regulating these waste streams and treatment units under RCRA. The samples that we are collecting are necessary to determine the need to regulate these streams.

3. The decisions related to listing additional coke plant residuals as hazardous wastes will be based on the criteria established in 40 CFR Part 261.11. These criteria are based on the potential hazard posed by the wastes and the potential for mismanagement of the waste and, as such, are not related directly to waste minimization concerns.

The listing of these wastes probably will not require major changes in the recycling and recovery practices that are used by many coke plants. The proposed rule for burning waste in boilers and industrial furnances (see 52 FR 17019), May 6, 1987), specifies that the coke and coal tar produced when tar decanter sludge (K035) is used as a feedstock are classified as products not wastes. The rationale for this proposal was that the residual and the normal feedstock or product have common constituents and that the residual streams and products are associated with the same

process. Based on our understanding of the residual streams that we are examining and the current recycling practices for those streams (use as a feedstock in the coke ovens or combination with tar in the decanter), these practices are likely to be deemed acceptable under the rationale established for the K035 stream.

4. The "trigger" levels that will be established under this listing/relisting study will not define technology-based limits to which residuals must be treated; they will be used to determine whether a waste stream is a "listed waste." When a waste stream has constituents at or below the "trigger" levels, or if it is treated to reduce constituents to those levels, it will cease to be a hazardous waste, unless it exhibits one of the hazardous characteristics defined in 40 CFR 261.21-24. If the residual stream has constituent concentrations above the "trigger" level, it will be a hazardous waste and must be treated, stored,and disposed in a manner that complies with the requirements of 40 CFR Parts 262 through 266 and 270.

5. As a part of this study, detailed information on waste management practices has been requested from most coke plant and tar refinery operators. These data will be compiled and summarized in the background documents that form the basis for the listing decision. Based on the recent proposal related to tar decanter sludge that was described above, we anticipate that the information presented in these background documents will enable the Agency to make sound judgements on environmentally acceptable management practices, as well as the potential

for a given waste to be improperly managed.

I hope that these responses have addressed the concerns that you raised in your May 26 letter. If you have questions about the responses please call me at (202) 382-4769.

Sincerely,

Original Document signed

Robert Scaberry
Chief, Listing Section

cc: Jeff Denit
Matt Straus
Ed Abrams
Dennis Wallace